

REMARKS/ARGUMENTS

Claims 92, 97, 99, 101, 104, 106-109, 118, 120-129, 151, 152 and 154-164 are pending; Claims 92, 97, 99, 101, 104, 106-109, 118, 120-129, 151, 152 and 154-164
5 have been currently amended; Claims 1-91, 93-96, 98, 100, 102, 103, 105, 110-117, 119, 130-150 and 153 have been canceled.

Response to Claim Rejections under 35 U.S.C. 103

10 Applicants respectfully traverse the rejections for at least the reasons set forth below.

Response to Claims 92, 97, 99, 101, 104, 106-109 and 118

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As currently amended, independent Claim 92 is recited below:
92. A chip package comprising:
a substrate comprising a solder mask layer and a first pad exposed by a first opening in said solder mask layer;
20 a silicon chip over said substrate, wherein said silicon chip comprises a second pad having a top surface with a first region, a second region and a third region between said first and second regions, and a passivation layer on said first and second regions, wherein an opening in said passivation layer is over said third region and exposes said third region;
25 a copper pillar between said second region and said first pad, wherein said second pad is connected to said first pad through said copper pillar;
a metal layer between said copper pillar and said third region, wherein said metal layer is on said second region, under said passivation layer and under said first and third regions; and
30 a tin-containing cap between said copper pillar and said first pad, wherein said tin-containing cap comprises silver, and wherein said tin-containing

cap has a first thickness less than a second thickness of said copper pillar.

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5 *Reconsideration of Claims 92, 93, 96, 97 and 99-119 rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura (U.S. Pat. No. 6,706,554) in combination with Burnette et al. (U.S. Pat. No. 6,552,436) is requested based on the following remarks.*

10 Applicants respectfully assert that the chip package currently claimed in Claim 92 patentably distinguishes over the citations by Ogura (U.S. Pat No. 6,706,554) and by Burnette et al. (U.S. Pat. No. 6,552,436).

15 Ogura teaches that a metal post 25 is on an electrode pad exposed by an opening in an insulating layer 12. The metal post 25 includes a metal layer 22 and a solder cap 26 on the metal layer 22. ~ See Fig. 1H; col. 4, lines 6-15 ~

However, Ogura fails to teach, hint or suggest that the metal post 25 may comprise a copper pillar, as currently claimed in Claim 92.

20 Furthermore, Ogura fails to teach, hint or suggest that the metal post 25 may comprise a tin-containing cap comprising silver, as currently claimed in Claim 92.

25 Furthermore, Ogura fails to teach, hint or suggest that there may be a metal layer between the metal post 25 and a pad exposed by an opening in a passivation layer, wherein the metal layer is not only on the pad but also under the passivation layer, as currently claimed in Claim 92.

30 The Examiner considers that Claims 92, 93, 96, 97 and 99-119 can be rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura (U.S. Pat. No. 6,706,554) in combination with Burnette et al. (U.S. Pat. No. 6,552,436). ~ See lines 11-13 on page 2, in the last Office Action mailed Nov. 20, 2007 ~

However, in the last Office Action, the Examiner fails to explain why the citation by Ogura (U.S. Pat. No. 6,706,554) can be combined with the citation by Burnette et al. (U.S. Pat. No. 6,552,436) for making a prima faice case against Claims 92, 93, 96, 97 and 99-119.

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The Examiner considers that “applicant’s claimed materials for example copper, silver alloy for either the pillar, metal/conductive layer or cap, applicant has not disclosed that his choice of material produce unexpected results or otherwise critical”.
~ See lines 11-13 on page 3, in the last Office Action mailed Nov. 20, 2007 ~

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In response thereto, a copper pillar currently claimed in Claim 92 may lead a great gap between a silicon chip and a substrate for improving stress release, which is not anticipated by Ogura. Furthermore, the copper pillar currently claimed in Claim 92 has excellent electric properties, which also is not anticipated by Ogura, because copper has low resistance.

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In response thereto, a tin-containing cap comprising silver, currently claimed in Claim 92, makes the connection between a copper pillar and a substrate reliable, which is not anticipated by Ogura.

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The Examiner considers that the limitation of “electroplated” metal is a product-by-process claim, and if the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. ~ See line 15 of page 4 through line 2 of page 5, in the last Office Action mailed Nov. 20, 2007 ~

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The applicant respectfully traverses the examiner’s opinion based on that the “electroplated” metal has a specific micro-structure that can be identified in a final product by the crystal orientation or the grain size using a TEM or an X-ray diffraction analysis.

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The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding "interbonded by interfusion" to limit structure of the claimed composite and noting that terms such as "welded," "intermixed," "ground in place," "press fitted," and "etched" are capable of construction as structural limitations.) ~ *Extracted from MPEP 2113* ~

Under the rule on MPEP 2113, it is believed that the structure of electroplated metal implied by a process step should be considered because "electroplated" metal can be expected to impart distinctive structural characteristics to the final product in the crystal orientation or the grain size by using a TEM or an X-ray diffraction analysis.

Withdrawal of rejection under 35 U.S.C. 103 (c) to Claim 92 is respectfully requested.

For at least the foregoing reasons, applicants respectfully submit independent Claim 92 patently distinguishes over the prior art references, and should be allowed. For at least the above reasons, dependent Claims 97, 99, 101, 104, 106-109 and 118 patently defines over the prior art as well.

Response to Claims 120-129 and 163

As currently amended, independent Claim 120 is recited below:

120. A bonding structure on a chip comprising a pad having a top surface with a first region, a second region and a third region between said first and second regions, and a passivation layer on said first and second regions, wherein an

opening in said passivation layer is over said third region and exposes said third region, comprising:

a metal layer on said third region, over said passivation layer and over said first and second regions;

5 a copper pillar on said metal layer, over said passivation and over said first and second regions; and

a tin-containing cap over said copper pillar, wherein said tin-containing cap comprises silver, and wherein said tin-containing cap has a first thickness less than a second thickness of said copper pillar.

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Reconsideration of Claims 120-123, 125-129 and 163 rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura (U.S. Pat. No. 6,706,554) in combination with Burnette et al. (U.S. Pat. No. 6,552,436) is requested based on the following
15 *remarks.*

Applicants respectfully assert that the bonding structure currently claimed in Claim 120 patentably distinguishes over the citations by Ogura (U.S. Pat. No. 6,706,554) and by Burnette et al. (U.S. Pat. No. 6,552,436).

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Ogura teaches that a metal post 25 is on an electrode pad exposed by an opening in an insulating layer 12. The metal post 25 includes a metal layer 22 and a solder cap 26 on the metal layer 22. ~ See Fig. 1H; col. 4, lines 6-15 ~

25 However, Ogura fails to teach, hint or suggest that the metal post 25 may comprise a copper pillar, as currently claimed in Claim 120.

Furthermore, Ogura fails to teach, hint or suggest that the metal post 25 may comprise a tin-containing cap comprising silver, as currently claimed in Claim 120.

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Furthermore, Ogura fails to teach, hint or suggest that there may be a metal layer between the metal post 25 and a pad exposed by an opening in a passivation layer,

wherein the metal layer is not only on the pad but also over the passivation layer, as currently claimed in Claim 120.

5 The Examiner considers that Claims 120-123, 125-129 and 163 can be rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura (U.S. Pat. No. 6,706,554) in combination with Burnette et al. (U.S. Pat. No. 6,552,436). ~ See lines 11-13 on page 2, in the last Office Action mailed Nov. 20, 2007 ~

10 However, in the last Office Action, the Examiner fails to explain why the citation by Ogura (U.S. Pat. No. 6,706,554) can be combined with the citation by Burnette et al. (U.S. Pat. No. 6,552,436) for making a prima facie case against Claims 120-123, 125-129 and 163.

15 The Examiner considers that “applicant’s claimed materials for example copper, silver alloy for either the pillar, metal/conductive layer or cap, applicant has not disclosed that his choice of material produce unexpected results or otherwise critical”. ~ See lines 11-13 on page 3, in the last Office Action mailed Nov. 20, 2007 ~

20 In response thereto, a copper pillar currently claimed in Claim 120 may lead a great gap between a silicon chip and a substrate for improving stress release, which is not anticipated by Ogura. Furthermore, the copper pillar currently claimed in Claim 120 has excellent electric properties, which also is not anticipated by Ogura, because copper has low resistance.

25 In response thereto, a tin-containing cap comprising silver, currently claimed in Claim 120, makes the connection between a copper pillar and a substrate reliable, which is not anticipated by Ogura.

30 The Examiner considers that the limitation of “electroplated” metal is a product-by-process claim, and if the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. ~ See line 15 of page 4

through line 2 of page 5, in the last Office Action mailed Nov. 20, 2007 ~

The applicant respectfully traverses the examiner's opinion based on that the "electroplated" metal has a specific micro-structure that can be identified in a final product by the crystal orientation or the grain size using a TEM or an X-ray diffraction analysis.

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The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding "interbonded by interfusion" to limit structure of the claimed composite and noting that terms such as "welded," "intermixed," "ground in place," "press fitted," and "etched" are capable of construction as structural limitations.) ~ *Extracted from MPEP 2113* ~

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Under the rule on MPEP 2113, it is believed that the structure of electroplated metal implied by a process step should be considered because "electroplated" metal can be expected to impart distinctive structural characteristics to the final product in the crystal orientation or the grain size by using a TEM or an X-ray diffraction analysis.

Withdrawal of rejection under 35 U.S.C. 103 (c) to Claim 120 is respectfully requested.

For at least the foregoing reasons, applicants respectfully submit independent Claim 120 patentably distinguishes over the prior art references, and should be allowed. For at least the above reasons, dependent Claims 121-129 and 163 patentably defines over the prior art as well.

Response to Claims 151, 152, 154-162 and 164

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5 As currently amended, independent Claim 151 is recited below:

151. A bonding structure on a chip comprising a pad having a top surface with a first region, a second region and a third region between said first and second regions, and a passivation layer on said first and second regions, wherein an opening in said passivation layer is over said third region and exposes said third region, comprising:

a metal layer on said third region, over said passivation layer and over said first and third regions;

a copper pillar on said metal layer, over said passivation and over said first and second regions; and

15 a tin-containing cap over said copper pillar, wherein said tin-containing cap has a first thickness less than a second thickness of said copper pillar, and wherein said tin-containing cap has a greatest transverse dimension less than that of said copper pillar.

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20 *Reconsideration of Claims 151-154, 156-162 and 164 rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura (U.S. Pat. No. 6,706,554) in combination with Burnette et al. (U.S. Pat. No. 6,552,436) is requested based on the following remarks.*

25 Applicants respectfully assert that the bonding structure currently claimed in Claim 151 patentably distinguishes over the citations by Ogura (U.S. Pat. No. 6,706,554) and by Burnette et al. (U.S. Pat. No. 6,552,436).

30 Ogura teaches that a metal post 25 is on an electrode pad exposed by an opening in an insulating layer 12. The metal post 25 includes a metal layer 22 and a solder cap 26 on the metal layer 22. ~ See Fig. 1H; col. 4, lines 6-15 ~

However, Ogura fails to teach, hint or suggest that the metal post 25 may comprise a copper pillar, as currently claimed in Claim 151.

5 Furthermore, Ogura fails to teach, hint or suggest that there may be a metal layer between the metal post 25 and a pad exposed by an opening in a passivation layer, wherein the metal layer is not only on the pad but also over the passivation layer, as currently claimed in Claim 151.

10 The Examiner considers that Claims 151-154, 156-162 and 164 can be rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura (U.S. Pat. No. 6,706,554) in combination with Burnette et al. (U.S. Pat. No. 6,552,436). ~ See lines 11-13 on page 2, in the last Office Action mailed Nov. 20, 2007 ~

15 However, in the last Office Action, the Examiner fails to explain why the citation by Ogura (U.S. Pat. No. 6,706,554) can be combined with the citation by Burnette et al. (U.S. Pat. No. 6,552,436) for making a prima faice case against Claims 151-154, 156-162 and 164.

20 The Examiner considers that “applicant’s claimed materials for example copper, silver alloy for either the pillar, metal/conductive layer or cap, applicant has not disclosed that his choice of material produce unexpected results or otherwise critical”. ~ See lines 11-13 on page 3, in the last Office Action mailed Nov. 20, 2007 ~

25 In response thereto, a copper pillar currently claimed in Claim 151 may lead a great gap between a silicon chip and a substrate for improving stress release, which is not anticipated by Ogura. Furthermore, the copper pillar currently claimed in Claim 151 has excellent electric properties, which also is not anticipated by Ogura, because copper has low resistance.

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In response thereto, a tin-containing cap currently claimed in Claim 151 makes the connection between a copper pillar and a substrate reliable, which is not

anticipated by Ogura.

The Examiner considers that the limitation of “electroplated” metal is a product-by-process claim, and if the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. ~ See line 15 of page 4 through line 2 of page 5, in the last Office Action mailed Nov. 20, 2007 ~

The applicant respectfully traverses the examiner’s opinion based on that the “electroplated” metal has a specific micro-structure that can be identified in a final product by the crystal orientation or the grain size using a TEM or an X-ray diffraction analysis.

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The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding "interbonded by interfusion" to limit structure of the claimed composite and noting that terms such as "welded," "intermixed," "ground in place," "press fitted," and "etched" are capable of construction as structural limitations.) ~ Extracted from MPEP 2113 ~

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Under the rule on MPEP 2113, it is believed that the structure of electroplated metal implied by a process step should be considered because “electroplated” metal can be expected to impart distinctive structural characteristics to the final product in the crystal orientation or the grain size by using a TEM or an X-ray diffraction analysis.

Withdrawal of rejection under 35 U.S.C. 103 (c) to Claim 151 is respectfully

requested.

For at least the foregoing reasons, applicants respectfully submit independent Claim 151 patentably distinguishes over the prior art references, and should be allowed.

- 5 For at least the above reasons, dependent Claims 152, 154-162 and 164 patentably defines over the prior art as well.

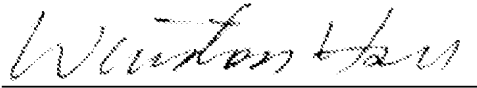
CONCLUSION

- Some or all of the pending claims are believed to be in condition for allowance.
10 Accordingly, allowance of the claims and the application as a whole are respectfully requested.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

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Sincerely yours,



Date: 02.20.2008

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- 25 Note: Please leave a message in my voice mail if you need to talk to me. (The time in D.C. is 13 hours behind the Taiwan time, i.e. 9 AM in D.C. = 10 PM in Taiwan.)